

Amino Acid Composition of Seeds of Some New Hybrid Varieties of Minor Millets

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Abstract:

Cereals are the staple diet of most of the world's population. Millets can secure India's food and farming in future because it is amazing in their nutrition contents. Minor millets are important source of protein in many developing countries. Proteins present in various foods differ in their nutritive value on account of the difference in the amino acid contents. The amino acid composition of nine hybrid varieties of minor millets seeds viz., Eleusine coracana (varieties FM & HR), Paspalum scrobiculatum (varieties JK-41, JK-48 & JK-439), Panicum sumatrense (varieties 8 & LMCO-2), Echinochloa frumentacea (varieties BMVL-29 & BMVL-172) were analyzed to ascertain the nutritional quality of the seeds by LC-MS.

Key Words: Amino acid composition, Minor millets varieties of Eleusine coracana, Paspalum scrobiculatum, Panicum sumatrense, Echinochloa frumentacea by LC-MS.

INTRODUCTION:

Food consists of three main classes of natural products: Carbohydrate, Proteins, and Fats, apart from the essential ingredients such as vitamins and minerals, while proteins supply the building materials of the body for its growth and for proper and balanced functioning of the various important organs. Proteins are compounds of carbon, hydrogen, nitrogen, oxygen sulphur and phosphorus. Barring water they are the chief substances in the cell of the body and form an important constituent of muscles and others tissues and vital fluids such as blood. They supply the building material to the body and make good the wear and tear of tissues which is a constant feature of the process of life. They are made up of various combinations of substances called amino acids. The nutritional quality of seed proteins largely depends on the amino acid composition of the storage proteins. Besides building cells and repairing tissue, amino acids form antibodies to combat invading bacteria and viruses; they are part of the enzyme and hormonal system. In addition, essential amino acids availability adds to improve the nutritional benefits in the seeds.

Protein deficiency in babies and young children causes not only physical impairment, but also permanent and irreversible brain damage [1]. As a result, protein-calorie malnutrition (PCM) has become one of the most outstanding dietary problems in India and other developing countries [2-3]. The problem of malnutrition (protein hunger) has been overcome with the introduction of new improved hybrid varieties of minor millets.

Millets are a group of cereal species crops or grain like food that has been used by large group of people in rural, tribal and hilly areas in Asia and Africa [4-7]. Millet is a cereal crop plant belonging to different genera but all within the grass family, Gramineae/Poaceae, subfamily Panicoideae [8-9].

Minor millets are high energy, nutritious foods comparable to other cereals and some of them are even better with regard to protein and mineral content. They are particularly low in phytic acid and rich in dietary fibre, iron, calcium and B vitamins. As the millets are consumed by the poor, they guard them against food and nutritional insecurity imposed by various agronomic, socio economic and political factors. Minor millets can thus act as a shield against nutritional deficiency disorders and provide nutritional security. These grains will be used for traditional as well as novel foods [10]. All of them are small seeded grasses having high capability of resistance to extreme environmental conditions in which major cereals fail to give substantial yields [11-13]. An analysis for amino acid by modern methods has given an excellent nutritive evaluation of the absorbed fraction of the food protein and thus, for this reason, one must be concerned with qualitative and quantitative adequacy of amino acids [14].

MATERIAL AND METHODS:

Collection of Samples:

New hybrid, authentic, healthy and matured seeds of minor millets viz., Eleusine coracana (variety FM & HR), Paspalum scrobiculatum (variety JK-41, JK-48 & JK-439), Panicum sumatrense (variety 8 & LMCO-2), Echinochloa frumentacea (variety VL-29 & VL-172), under investigation were procured from Agriculture Research Station of Jawaharlal Nehru Krishi Vishwavidyalaya, Dindori (M.P.).

EXPERIMENTAL SETUP:

The amino acid composition of nine hybrid varieties of minor millets seeds viz., Eleusine coracana (variety FM & HR), Paspalum scrobiculatum (variety JK-41, JK-48 & JK-439), Panicum sumatrense (variety 8 & LMCO-2), Echinochloa frumentacea (variety VL-29 & VL-172), were analyzed by using liquid

chromatography/electrospray ionization mass spectrometry (LC/ESI-MS) /LC-MS method.

SOLVENT EXTRACTION & SAMPLE PREPARATION:

Solvent extraction was done by Soxhlet Apparatus and stock solution was prepared by dissolving 10mg of each amino acid in 100ml of diluents and it was properly shaken. Working standard solution of 1mg/L was prepared by this stock solution.

LC-MS (Liquid) analysis:

LC-MS analysis of sample was done by using C18 column (Brava Amino 5 μ , 4.6 \times 250mm). Column temperature was maintained at 40°C. 10 μ l of sample was injected for 10 min. 0.1% Formic acid in water and 0.1% Formic acid in acetonitrile (95+5) were used as mobile phase and its flow rate was 0.8ml/min. Ionization of sample component were performed on ESR mode (70 eV).

RESULTS AND DISCUSSION:

The results of amino acid composition of seed protein of minor millets are given in the table. In both the varieties of Eleusine coracana (FM & HR), the quantity of Aspartic acid were found to be maximum, i.e., 0.429% for FM and 0.361% for Eleusine coracana HR followed by Glutamic acid (0.037% & 0.034% respectively). It has been observed that in both the varieties of Eleusine coracana, the quantities of various amino acids are somewhat to the same extent. Other amino acid in the decreasing order were lysine, methionine, DL-Tryptophan, isoleucine, L-omithine HCl, alanine, serine, arginine HCl, valine, glycine=proline, phenylalanine=tyrosine, leucine=L-Hydroxyproline=threonine.

In the Paspalum scrobiculatum (variety JK-41, JK-48 & JK-439), the quantity of Aspartic acid is found to be highest, i.e., 0.709%, 0.707 and 0.708% followed by Methionine acid (0.030% & 0.033% & 0.031% respectively). It has been observed that in all the varieties of Panicum sumatrense, the quantities of various amino acids are somewhat to the same extent. Other amino acid in the decreasing order were L-omithine HCl, arginine HCl, glycine, isoleucine, glutamic & proline, serine, lysine, DL-Tryptophan, valine, threonine, alanine, phenylalanine, tyrosine, leucine, L-Hydroxyproline.

In both the varieties of Panicum sumatrense (variety 8 & LMCO-2), the quantity of Aspartic acid is found to be maximum (0.211% & 0.211%) followed by Methionine acid (0.037% & 0.036% respectively). However, the decreasing order of other amino acid in kutki variety 8 were alanine, DL-Tryptophan, glutamic, lysine, L-omithine HCl, proline, arginine HCl=serine, glycine, valine, tyrosine,= phenylalanine, threonine,

leucine=L-Hydroxyproline, isoleucine. While in variety Panicum sumatrense -LMCO-2 the decreasing order of amino acid were alanine, DL-Tryptophan, glutamic, lysine, L-omithine HCl=proline, arginine HCl=serine, glycine, valine, tyrosine, phenylalanine, threonine.= leucine, L-Hydroxyproline, isoleucine.

The highest amount of Aspartic acid (0.522%) followed by Lysine (0.047% & 0.046%) was found in the Echinochloa frumentacea (variety BMVL-29 & BMVL-172). In both the variety of sanwa, other amino acid in the decreasing order were glutamic, methionine, L-omithine HCl, alanine, arginine HCl, DL-Tryptophan, serine, glycine, proline= valine, threonine, tyrosine, phenylalanine, leucine=L-Hydroxyproline>isoleucine.

From the above analysed data indicated that all the varieties of minor millets seeds are lacking in Cystine, Histidine, 2-Aminobutanic and L-cysteine amino acids and quantitative estimation of the amino acids it has been found that the amount of aspartic acid were maximum while the quantity of isoleucine were found minimum but methionine levels of these variety of minor millets were higher the amounts present in cereal grains [15-17]. Methionine is of special importance to animals as a therapeutic and nutritional factor. It protects animals against liver injuries by chloroform, industrial halogenated fumes, protein deficient diets and prevents the great loss of body nitrogen in the case of fractures, burns and surgical operations [18]. However, the amino acid composition of seed protein of all the variety of minor millets under study was found to be in good accordance with reported values [19-20]. Variations in the various constituents of the minor millets seeds have been attributed to variety, conditions, fertilizer treatments and climatic conditions. Hence all the varieties of the minor millets seeds contain good quantities of essential amino acids, suitable for good nutritional supplementation.

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Table -Amino acid composition of hybrid variety seeds of Minor Millets

S.N o	Amino Acid	Amino acid analysis (content in %)								
		Eleusin e conoana -FM	Eleusin e conoana -HR	Paspalm scrobiculatum , JK-41	Paspal scrobiculatum , JK-48	Paspalm scrobiculatum , JK-439	Panicm sumatre n se-8	Panicumsumatrens e LMCO-2	Echinochlo a frumentaca BMVL-29	Echinochlo a frumentace a BMVL-172
1	Alanine	0.016	0.017	0.002	0.001	0.002	0.034	0.035	0.015	0.016
2	Arginine HCl	0.009	0.013	0.015	0.014	0.015	0.011	0.011	0.014	0.013
3	Aspartic	0.429	0.361	0.709	0.707	0.0708	0.211	0.211	0.522	0.522
4	Cystine	ND	ND	ND	ND	ND	ND	ND	ND	ND
5	Glutamic	0.037	0.034	0.007	0.007	0.006	0.021	0.020	0.027	0.034
6	Glycine	0.004	0.004	0.012	0.013	0.012	0.010	0.010	0.006	0.006
7	Histidine	ND	ND	ND	ND	ND	ND	ND	ND	ND
8	Isoleucine	0.0019	0.0026	0.0008	0.0008	0.0007	0.0023	0.0022	0.0009	0.0008
9	Leucine	0.002	0.003	0.001	0.002	0.001	0.002	0.002	0.001	0.002
10	Lycine	0.046	0.050	0.003	0.003	0.003	0.018	0.018	0.047	0.046
11	Methionine	0.033	0.035	0.030	0.033	0.031	0.037	0.036	0.027	0.025
12	Phenylalanine	0.003	0.003	0.001	0.001	0.001	0.004	0.003	0.002	0.002
13	Proliney	0.004	0.004	0.007	0.007	0.007	0.012	0.012	0.004	0.004
14	Serine	0.011	0.010	0.005	0.006	0.005	0.011	0.011	0.011	0.011
15	Threonine	0.002	0.001	0.002	0.002	0.001	0.003	0.002	0.003	0.002
16	Tyrosine	0.003	0.004	0.001	0.001	0.001	0.004	0.004	0.002	0.003
17	Valine	0.006	0.008	0.002	0.001	0.002	0.007	0.007	0.004	0.004
18	2- Aminobutanic	ND	ND	ND	ND	ND	ND	ND	ND	ND
19	L-Omithine HCl	0.018	0.022	0.023	0.022	0.023	0.013	0.012	0.023	0.023
20	L-Cysteine HCl	ND	ND	ND	ND	ND	ND	ND	ND	ND
21	DL- Tryptophan	0.025	0.031	0.002	0.002	0.002	0.022	0.025	0.012	0.012
22	L- Hydroxyprolin e	0.002	0.003	0.001	0.001	0.001	0.002	0.001	0.001	0.001

*ND- Not Detected